

# Changes in sleep architecture increase hunger, eating

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A new study shows that both length of time and percentage of overall sleep spent in different sleep stages are associated with decreased metabolic rate, increased hunger, and increased intake of calories (specifically from fat and carbohydrates). The findings suggest an explanation for the association between sleep problems and obesity.

Researchers from St. Luke's-Roosevelt Hospital and Columbia University investigated the effects of sleep architecture on hunger to determine whether specific stages of sleep, rather than simple duration, would affect changes in appetite and food desires in healthy adults.

The article is entitled "Alterations in sleep architecture in response to experimental sleep curtailment are associated with signs of positive [energy balance](http://bit.ly/S69LsW)" (<http://bit.ly/S69LsW>). It appears in the online edition of the [American Journal of Physiology – Regulatory, Integrative and Comparative Physiology](#) published by the [American Physiological Society](#).

## Methodology

Researcher Ari Shechter and colleagues designed a laboratory-based, randomized crossover study of 27 healthy adults between the ages of 30 and 45. Participants underwent two six-day periods of laboratory observation—a "habitual sleep" phase, during which they were allowed nine hours to sleep, and a "short sleep" phase, during which they were

allowed four hours to sleep. Each phase was separated by four weeks to ensure full recuperation from the short sleep condition and to ensure that women were observed at the same phase of their menstrual cycle under each condition. Sleep duration and composition were assessed using polysomnographic recording. The amount of time spent in each sleep phase—stage 1, stage 2, [slow wave sleep](#) (or SWS—stage 3 and 4 combined) and REM sleep— was determined and expressed in minutes and as a percentage of total sleep time.

For the first four days in both phases, participants ate meals calibrated to meet their [energy requirements](#) for weight maintenance. On day four, participants were asked to rate their hunger and level of desire for different foods. Resting metabolic rate (RMR) was measured in the fasted state on day five, and participants were then allowed to select their own foods for the final two days. Researchers compared participants' sleep architecture in the short sleep and habitual sleep condition, and analyzed the relationships between their sleep architecture, RMR, food intake and appetite-satiety ratings.

## Results

Shechter and colleagues found that, compared to habitual sleep length, the short sleep condition resulted in reductions in the duration and percentage of stage 2 and REM sleep and increased the percentage of total sleep time spent in SWS. Some of these changes were related to decreased RMR, increased feelings of hunger, and increased intake of calories, fat, and carbohydrate. Specifically, there was a positive association between stage 2 sleep duration and RMR, and an inverse relation between stage 2 sleep percentage and calories consumed—i.e., the less stage 2 sleep, the lower RMR and more calories consumed. There was an inverse relationship between REM sleep duration and hunger, and an inverse relationship between the amount of stage 2 sleep and desire for sweet and salty food. Reduced percentage of [sleep time](#)

spent in [REM sleep](#), as well as SWS, was also associated with greater fat and carbohydrate intake.

## Importance of the Findings

The results reinforce that [sleep duration](#) is important, but show that the composition of sleep—the time and percentage of overall sleep spent in each stage—is also playing an important role in the relationship between sleep and obesity. "Any number of various factors like obstructive sleep apnea, certain drugs/medications, chronic exposure to [short sleep](#) duration, shift work, jet lag, and changes in the scheduling of the sleep episode, can affect [sleep](#) stage quantity and distribution," said Shechter. "Our data may provide an explanation for the greater obesity prevalence observed within some of these conditions."

Provided by American Physiological Society

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